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RECORD OF REVISIONS

Rev	Date	Description	POC	OIC
0	06/28/99	Document rewritten to support LIR 220-03-01. Superseded Architectural Facilities Engineering Standards, Vol. 4, Manual Rev. 6, dated 2/17/98.	Miles Brittelle, <i>PM-DS</i>	Dennis McLain, <i>FWO-FE</i>
1	11/18/02	General revision and addition of endnotes. Replaces subsections 100, 102, 200, 209, 211. Section 13.0, Siting, is new.	Scott Richardson, <i>PM-I</i>	Kurt Beckman, <i>FWO-SEM</i>
2	8/16/04	General requirements now in ESM Chapter 1 Sect Z10. Added ADA, visual screening, firestopping, and sitework requirements. Landscaping expanded. LEM changed to ESM.	Scott Richardson, <i>PM-DS</i>	Gurinder Grewal, <i>FWO-DO</i>

CONTACT THE ARCHITECTURAL STANDARDS POC

for upkeep, interpretation, and variance issues

Ch. 4, B-C_GEN	<u>Architectural POC/Committee</u>
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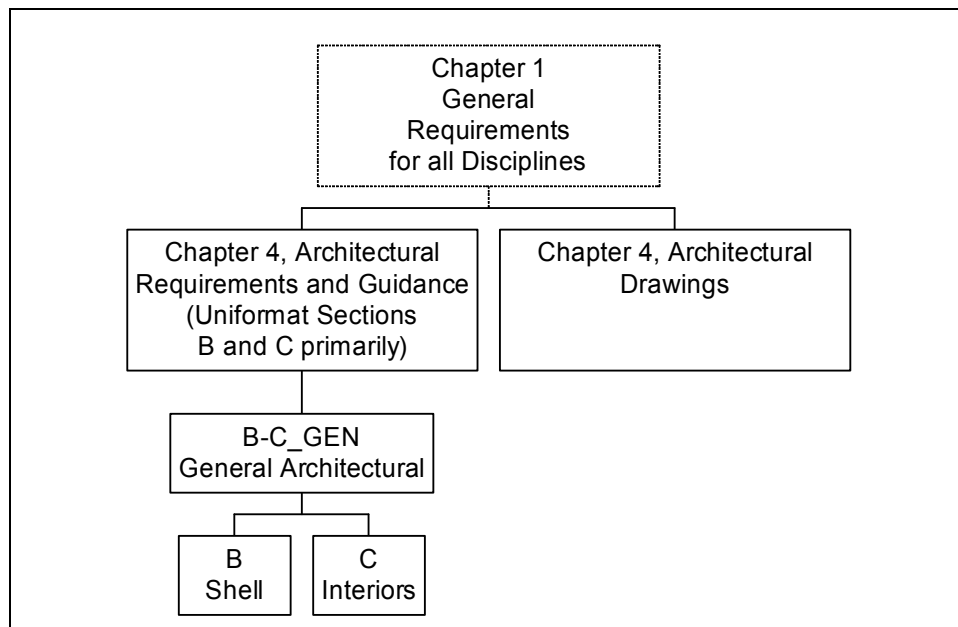
B-C_GEN GENERAL ARCHITECTURAL REQUIREMENTS

1.0 APPLICATION OF THIS CHAPTER

1.1 General

- A. The purpose of this chapter of the LANL Engineering Standards Manual (ESM) is to provide architectural systems that prevent accidents and mitigate consequences; are free from hazard; are efficient, convenient, and adequate for good service; and are maintainable, standardized, and augmented by the site-specific requirements in this chapter.
- B. All architectural design, material, equipment, and installations shall comply with site-specific requirements in this Chapter and Chapter 1 of the ESM.¹

This hierarchy and the organization of this chapter are depicted below:



- C. Where appropriate, guidance is provided to aid the cost-effective implementation of site-specific requirements and the requirements in the applicable codes. *Italicized* text identifies recommended guidance (not mandatory), based on good business practice and through lessons-learned at LANL (except when clearly indicating the title of a document). All other text in regular type indicates **mandatory** requirements unless prefaced with wording identifying it as guidance or recommended.
- D. In addition to new architectural installations, this Chapter applies to all renovation, replacement, modification, maintenance, or rehabilitation projects. See ESM Chapter 1 Section Z10, Renovations subsection.¹

¹ LANL [LIR 220-03-01](#), "Engineering Standards" is the implementation requirement document for this manual. Refer to Sections 2.0 and 3.0 for statements of the purpose, scope and applicability of the ESM.

2.0 ACRONYMS AND DEFINITIONS

AHJ	Authority having jurisdiction
Design Agency	The organization performing the detailed design and analysis of a project or modification.
Design Authority	The person or group responsible for the final acceptability of and changes to the design of a system or component and its technical baseline (typically the manager of engineering).
LCSM	LANL Construction Specification Manual
ESM	LANL Engineering Standards Manual
LIG	Laboratory Implementation Guidance
LIR	Laboratory Implementation Requirements
Major Project	Construction project greater than \$500k (CPM LIR 220-01-01).
POC	Point of contact. For the ESM chapter/discipline POC and Technical Committee see http://www.lanl.gov/f6stds/pubf6stds/techcommittees.html
Small Construction Project	Construction project below \$500k.
WSS	Work Smart Standards. A set of Orders and national codes and standards in Appendix G of the LANL UC Contract. They primarily address Health, Safety, and Radiation (HSR).

3.0 GENERAL

A. Asbestos-containing architectural products are prohibited.

4.0 CODES AND STANDARDS

4.1 Building Code

WSS = Work Smart Standard, a contractual requirement for work at LANL.

- A. International Building Code (IBC), published by the International Code Council (WSS).
1. Refer to NFPA Codes (except NFPA 5000) in this section for deviations from IBC.
 2. Administrative sections of the IBC related to municipalities (e.g., permit fees, inspections) do not apply at LANL.
 3. Mechanical, Plumbing, Fire, Electrical, Energy, and other Codes to be followed shall be as required by governing ESM chapters (i.e., where ESM-required Codes are different than the IBC-referenced I-Codes, the ESM governs).
- B. Where the above codes refer to the Administration Authority for architectural matters, refer to the ESM Architectural POC.

4.2 Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA)

NOTE: For assistance on whether this can be waived, contact LANL Office of Equal Opportunity (OEO); internally: <http://int.lanl.gov/orgs/oao/disabilities.htm>. *Guidance: Waivers have been granted for process areas where contamination is present, access is impractical, and/or fast evacuation may be necessary. OEO may involve Laboratory Counsel in the decision.*

For the text of (and discussion on) the Acts and associated standards for compliance with them, see <http://www.access-board.gov> ("About..." and "Accessibility Guidelines..." links) or <http://www.usdoj.gov/crt/ada/stdspdf.htm>

- A. Comply with the Americans with Disabilities Act, Public Law 336 of the 101st Congress, enacted July 26, 1990 (ADA-1990) and 28CFR36, Nondiscrimination on The Basis of Disability by Public Accommodations and in Commercial Facilities (link http://www.access.gpo.gov/nara/cfr/waisidx_03/28cfr36_03.html until superceded); and the Architectural Barriers Act (ABA)
- B. For the ABA, as a minimum, comply with the Uniform Federal Accessibility Standards (UFAS) <http://www.access-board.gov/indexes/accessindex.htm>
- C. Design, construction, or alteration of facilities in conformance with the Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) (Appendix A to the Department of Justice's final rule implementing Title III of the ADA) shall be deemed to comply with the requirements of this section with respect to those facilities, except that the elevator exemption contained at {4.1.3(5)} and {4.1.6(1)(j)} of ADAAG shall not apply. Departures from particular requirements by the use of other methods shall be permitted when it is clearly evident to the Architectural POC that equivalent access to the facility or part of the facility is thereby provided.
 - 1. *Guidance: Additional guidance can be found in ICC/ANSI A117.1 standard, "Accessible and Usable Buildings and Facilities."*
- D. For future publically-accessible buildings (e.g., Otowi and Study Center-like spaces), auxiliary aids and services shall be provided to individuals with vision or hearing impairments or other individuals with disabilities, unless an undue burden would result. (35.151) Agreement to not comply must be obtained from Engineering Standards Architectural POC and LANL OEO.
- E. Ensure access control equipment (e.g., entry facilities including airlocks, badge and palm readers including restriction of projections thereof) accommodates the disabled.
- F. The work involved with renovations, alterations, and remodeling of existing facilities shall comply with this section; the stipulations of Chapter 1 Section Z10 on renovation also apply.

4.3 NFPA (National Fire Protection Association)

A. National Fire Codes and Standards (WSS)

1. Buildings and structures designed to fully meet the requirements of NFPA 101, The Life Safety Code, shall be considered to have met the “life safety egress” requirements of IBC, OSHA (29 CFR 1910), and all other codes.²

- B. Listing of current NFPA codes and standards are available at:
<http://www.nfpa.org/catalog/Home/index.asp> or, for LANL at:
<http://lib-www.lanl.gov/infores/stand/stanihs.htm>

5.0 DESIGN DOCUMENTATION

5.1 General

- A. Prepare an Energy Efficiency/Sustainable Design Report per Section Z10 of ESM Chapter 1.

5.2 Evacuation Route Diagrams and Life Safety Plans

- A. Produce for all new buildings and modify existing plans when altering existing buildings. Follow [LANL Drafting Manual](#) requirements. *Guidance: The Drafting Manual also has requirements for demolition, foundation, reflected ceiling, and floor finish plans; and elevations and sections (e.g., Section 304).*

5.1 Project Design Data

Include Project design data on the first architectural sheet of all definitive design packages. If necessary, use a small plan of the building to identify various conditions.

- A. The following information is required as a minimum:³
1. **Occupancy Classification:** Identify the IBC and the NFPA 101 occupancy classifications. Identify occupancy separations provided for hazardous type uses.
 2. **Type of Construction:** Identify type of construction as defined by the IBC. Identify areas that may have different types of construction, area separation walls, and state whether an automatic fire sprinkler system was substituted for 1-hour fire resistive construction.
 3. **Building Areas and Number of Stories** (as defined by IBC): Identify total area of structure, area of each floor if applicable, number of stories, and the allowable areas and stories per IBC. Also note if allowable building area was increased based upon use of an automatic fire sprinkler system.
 4. **Corridors and Area Separations:** Identify the fire rating of corridor walls and note if an exception based upon use of an automatic fire sprinkler system was taken. Identify any area separation walls and reason for their use.
 5. **Floor and Roof Loadings:** Identify the floor and roof live loads used in the design of the structure.

² [LIR402-910-01](#), LANL Fire Protection Program.

³ The intent of this information is to determine the code and design basis upon which the project was developed.

6. **Hazard Classifications:** List the hazard classifications and performance categories used in the design of the structure.
7. Address codes/editions followed, occupant number assumptions and limits, and egress analysis.

5.2 Floor Plan of Record (FPR)

- A. Produce for all new buildings and modify existing plans when altering existing buildings. Follow LANL Drafting Manual requirements
- B. Refer to the Architectural Example Drawings A-1000 and A-1001 for floor plans of record.

5.3 Roof Plan of Record (RPR)

- A. Produce for all new buildings and modify existing plans when altering existing buildings. Follow LANL Drafting Manual requirements
- B. Refer to Architectural example drawings A-1051 and A-1052 for roof plans of record.

6.0 DESIGN PRINCIPLES

6.1 General

- A. The vision for the physical development of the Laboratory is to create an exceptional work environment that supports its mission, and attracts and retains the quality personnel needed to meet that mission. Using the standard of a world-class working environment the Laboratory sets out to revitalize and develop its facilities and infrastructure in a manner that improves and upholds the functionality, safety, security and appearance of the built environment. To that end, the Site and Architectural Design Principles document, LA-UR-01-5383, January 2002 was published to provide, early in a project's life, end-result direction towards meeting those goals.⁴ The document is intended to provide maximum latitude in design decisions while maintaining consistency in the final product at the institutional level by implementing the principles therein on every project regardless of project size.

1. The Site and Architectural Design Principles document can be found at:
http://www.lanl.gov/orgs/f/f6/pubf6stds/engrman/4arch/htmls/site_arch.htm

Additionally, bound hardcopies and portable document files (pdf) on compact disc can be obtained from the PM Division's Site and Project Development group [PM-1](#).

2. Also see "Sustainable Design" in Section Z10 for further design direction.

⁴ The Site Planning and Construction Committee (SPCC) members endorsed the *Site and Architectural Design Principles* original 2001 version (LA-UR 01-5383) document for Laboratory use per the Comprehensive Site Planning LPR and LIR requirement on October 10, 2001(EMRef-16).

7.0 SITING & SITE DEVELOPMENT

- A. Coordinate siting of all structures with Project Management Division's Site and Project Development Group (PM-1).
- B. Appropriate levels of site development such as sidewalks, parking lots, lot and walkway lighting, provision for parking of maintenance and delivery vehicles close to the building, and site improvements shall be provided by and for each project as determined by the associated LANL master plans, area development plans, comprehensive site plans and the Site and Architectural Design Principles document. Contact PM-1 for assistance.
- C. Primary building entries, whenever feasible, shall have southern orientation for winter solar exposure to minimize problems due to snow and ice unless a variance is obtained. Similarly, major pedestrian ways (sidewalks, plazas, building approaches, etc) shall be oriented, and solar access to them protected, to maximize winter solar exposure. Artificially heated walkways are not to be utilized without a variance obtained.⁵
- D. For fire-related building separations and wildland fire-based clearance zones follow ESM Fire Chapter Section D40 (Exposure and Natural Phenomenon Hazards Protection subsection).
- E. For Right-of-Way requirements follow ESM Civil Chapter Section G30 Site Civil/Mechanical Utility, Utility Line Clearances Above Ground Subsection -- and ESM Electrical Chapter 7 Section G4010.
 - 1. For other utilities, contact FWO-UI for ROW distances and underground interference locations.

8.0 FIRESTOPPING

- A. In addition to the firestopping required by the IBC, consider other locations necessary to protect nuclear materials, valuable experiments, or sensitive equipment (e.g., computers, telecon, instruments, experiments).
- B. Refer to LANL Construction Specifications, Section 07840 - Firestopping.

D1010 ELEVATORS

- A. Multi-level structures, regardless of occupancy type, shall have at least one elevator serving every level. At least one such elevator shall accommodate a 24"x76" ambulance stretcher in its open, horizontal position (expands upon IBC 2003, Section 3002.4 that requires this for structures of 4 stories and greater).
- B. See additional elevator requirements in the ESM Mechanical Chapter (*Section D10+E10*).

⁵ EMRef-29 E-mails on SCC Problems from Maez and Ojeda to Oruch June/July-04

E20 FURNISHINGS

1.0 GENERAL

- A. System or “contract” furniture shall not be anchored to partitions or walls but shall be freestanding and self supporting. Refer to LANL Construction Specifications Section 12500, System Furniture and Seating.
- B. Refer to the following LANL Construction Specifications:
 - 1. *Section 06200, Finish Carpentry (guidance unless dated 2004 or later)*
 - 2. *Section 06410, Custom Casework (guidance unless dated 2004 or later)*
 - 3. *Section 12301, Metal Casework (guidance unless dated 2004 or later)*
 - 4. *Section 12512, Horizontal Louver Blinds (guidance unless dated 2004 or later)*

F1010 PRE-ENGINEERED STRUCTURES

1.0 GENERAL

- A. *Guidance: Refer to the ESM Chapter 1 Section Z10 discussion of Temporary Facilities (if applicable) and LANL Construction Specifications, Section 13125, Pre-Engineered Metal Buildings (guidance unless dated 2004 or later).*

G2040 EXTERIOR SCREENS AND SIGNS

1.0 EXTERIOR SCREENS

- A. Permanent visual screening shall be provided for unsightly areas such as refuse containers, HVAC and electrical equipment (whether roof mounted or pad mounted), delivery areas, etc. *The preferred method of screening is louvered materials and assemblies with louvers oriented in such a way as to allow passage of winter sun to aid the melting of snow and ice.*

2.0 EXTERIOR SIGNS

2.1 General

- A. Provide General Road Signs in accordance with the *Manual on Uniform Traffic Control Devices* (MUTCD) <http://mutcd.fhwa.dot.gov/> Refer to LANL ESM Chapter 3, Civil for detailed requirements.⁶

2.2 Technical Area Signs

- A. Locate technical area freestanding signs at the entrances to a technical area and all locations within the technical area where designation of the area is important.

⁶ The MUTCD is a LANL Work Smart Standard.

- B. When sited at an entrance road to an area, the face of the sign shall be perpendicular to the major road.
- C. Locate freestanding signs a minimum of 15 feet back from any road edge.
- D. Locate signs outside the clear sight triangle of intersections and set back a minimum of 20 feet from the driveway edges.
- E. For details, comply with the Architectural Standard Drawing(s) ST-G2040-4, Exterior Signs.⁷

2.3 Structure Signs

- A. Signs are required on all buildings, transportables, trailers, transportainers, and other large outdoor structures (transformers, tanks, switchgear, antenna, etc.).
- B. Numbers: Obtain structure numbers from the Project Management Division Site and Project Development Group, PM-1, as part of the siting process. *Guidance: A structure identified as 55-4 is Building 4 in Tech Area 55.*
 - 1. Format: Comply with the Architectural Drawing(s) ST-G2040-4, Exterior Signs.
 - 2. Proposed facility identification signs (freestanding and building mounted) are to be approved by PM-1 prior to project design completion.
- C. Building Signs
 - 1. *Guidance: Adjustments to the following will often be needed for best placement based on the requirements of the individual project. The primary considerations are visibility of structure identification for emergency and way-finding purposes and appearance of the location of the signs in context with the structure's shape and other features. Contact the ESM Architectural Point of Contact for assistance if needed.*
 - 2. Location: Locate structure signs on the right-hand end of the building face first seen from the street and/or parking area. Install the top of the sign approximately 6 feet above adjacent grade, and 1 foot in from the corner of the building. If plants, parked vehicles, etc. block the sign location described above, move the sign up, or to the left, or both, as needed to clear the obstruction. Use more than one structure sign if needed.
 - 3. Provide additional sign(s) on buildings near building entrance where appropriate.
- D. Transportainer Signs
 - 1. Locate signs as high as possible in the upper right or left-hand corner of the structure. Place the number on the side or end that has the access doors.

⁷ The Site Planning and Construction Committee (SPCC) members endorsed the *Site and Architectural Design Principles* 2001 version (LA-UR 01-5383) document for Laboratory use per the Comprehensive Site Planning LPR and LIR requirement on October 10, 2001. Also endorsed during that meeting was the new metal wayfinding (signs) with teardrop cross-section uprights (EMRef-16).

G2050 LANDSCAPING**1.0 GENERAL**

This section sets forth minimum design criteria for planting, seeding, sodding, and irrigation for the landscaping of new facilities or re-vegetation of disturbed sites due to construction activities. The objectives of landscaping for the Laboratory are as follows:

- A. Use landscaping and re-vegetation to prevent erosion, runoff and soil damage to new and existing facilities.
- B. Use plants to modify environmental problems such as temperature fluctuations, snow accumulation, wind, noise, glare and light reflection, and energy and water conservation.
- C. Landscaping can be used to control visual clutter for security, safety and aesthetic reasons. Planting designs will support the security and safety requirements of each project while improving the visual appearance of the area.
- D. Planting design and installation should minimize long term maintenance requirements while maximizing functional and aesthetic uses.
- E. Because LANL is made up of scattered research areas rather than being a unified complex, landscaping can be used to create a cohesive look for the Laboratory and enhance the work environment.

2.0 LANDSCAPE SITE FACTORS

- A. Site factors for planting, seeding, and sodding may exist separately or in various combinations. Consider the following factors for landscaping or re-vegetation of construction areas:
 - 1. Drainage
 - 2. Topography
 - 3. Soils
 - 4. Climatic data
 - 5. Existing Vegetation
 - 6. Security Requirements
 - 7. Pedestrian Circulation
 - 8. Maintenance Requirements

3.0 LANDSCAPE DESIGN ELEMENTS (REQUIREMENTS)

- A. Planting Plan: Show exact locations of proposed and existing plant materials, seeding, and sodding within the project area in the planting plan. Follow the ESM Drafting Manual. Draw plant materials at approximately two-thirds their mature spread, unless they are exceptionally slow growing, then the plant should be drawn at half their mature spread.

- B. Plant List Schedule: Include a plant list on the drawings. The plant list shall contain the following: The symbol or abbreviation for the plant used on the plan, the common and botanical names of the plant, installation size, spacing, and any special notations. Group the plant list by trees, shrubs, vines and ground covers. Indicate trees as containerized or balled and burlap (B&B) material, and single or multi-trunk as appropriate per species.
- C. Planting Details: Include planting details in the Drawings.
- D. Specifications: Use LANL Standard Construction Specifications. Carefully examine and edit the specification as needed for each project. Standard Specifications cover irrigation (02811), seeding (02936), sodding (02938), and trees, plants, and groundcover (02950).
- E. Seeding Schedule: Include a seeding schedule in the Drawings, which includes lawn or native grasses to be seeded. The seeding schedule shall list: common and botanical names of the grasses and application rate for each grass type. Native grass seed rates shall be in pure live seed pounds (lb/P.L.S.) per acre, or in lb/P.L.S. per thousand square feet for areas of a quarter acre or less. Refer to the Grass Characteristics and Adaptations Matrix (Table 1).
- F. To reinforce a sense of unity, use plants and design themes that complement existing landscape on adjacent sites. If a change in a material or design theme is desired, a transition area should be designed rather than abruptly changing materials or design. Use landscape materials that reinforce the high mountain pine setting. Avoid formal planting arrangements except in highly public locations such as administrative buildings and visitor areas.

4.0 CONSIDERATIONS FOR INSTALLATION

- A. Coordinate landscaping with stormwater management requirements in ESM Civil Chapter 3 Section G10-G1030 and the LANL Sustainable Design Guide Section 3 (*pgs 147-153 of Rev. 0*).
- B. Protection of Existing Trees: Require a temporary construction fence or barrier 2 feet beyond the drip line to protect the roots. Save pine trees larger than 10 inches in a trunk diameter whenever possible. *Guidance: Grades within the drip line of the tree should not be altered.*
- C. Use of Native and Drought Tolerant Plants: Whenever practical, to reduce maintenance, use native and drought tolerant plants that, after establishment, can survive on available rainfall and are adapted in local growing conditions. Plan for native and drought tolerant plants to be irrigated during the first growing season with water being reduced after the first growing season gradually acclimate the plants to the natural water regimen.
- D. Soil Preparation: Examine the job site to determine the extent and quality of the existing subgrade material and whether top soil is available as part of the grading operation. Determine if top soil or top dressing should be imported to the site and the extent of scarification required. If material quality is in doubt, arrange soil tests to determine the soil type and the required soil mix and soil amendments to be used to enhance the growth characteristics. Consider soil amendments including commercial fertilizers, top soil, sand, and mulch.

- E. Fertilizer Guidance: *The use of fertilizer in landscaping design depends on highly variable circumstances. These include location, schedule, desired short-term results, soil type, and installation methods. In the case of plantings, fertilizer tablets may be considered, depending on time of year, size, and condition of the plants involved. In general, it is Laboratory policy to keep fertilizing to the minimum that will assure growth and desired results over a reasonable period of time. Instant results are not necessarily desirable, at the expense of plant health, maintenance requirements, or environmental concerns.*
- F. Unapproved Materials: Do not include the following for the reasons stated:
1. Kentucky Bluegrass is not well adapted to the Los Alamos climate, requires excessive water, and can be expensive to cultivate and maintain.
 2. Manure as a fertilizer or soil amendment. Manure that is not properly aged can introduce harmful chemicals. In addition, quality is difficult to control and manure can contain seeds of unwanted or noxious weeds.
 3. Herbicide may contain materials that are harmful to the environment. They are not considered necessary or desirable for initial installations.

5.0 DESIGN CONSIDERATIONS FOR MAINTENANCE

- A. Maintenance (i.e., watering, fertilizing, weeding) of a seeded or sodded area after initial installation will directly affect the results of the project. The seeded areas shall receive a regular watering, weeding, and fertilizing program to produce a higher germination rate and a healthier, stronger grass stand. Native grass seed mixtures will not germinate at the same time, protecting the species from total elimination if adverse conditions are present. When optimum conditions exist over a period of time (at least 60 days), more seed will germinate. It is recommended to have a watering program for a minimum of 60 days, unless planting is near fall frost. However, if this is not possible, time of seeding is important to guarantee optimum results.
- B. High Maintenance Zone: Areas immediately adjacent to buildings or pedestrian plazas. Maintenance in this zone will usually be weekly to semi-monthly and include mowing. Plants requiring frequent maintenance such as sodded lawn, ornamental shrubs and flowers shall be limited in use to high maintenance zones, and should be clustered in easily maintained areas.
- In general, limit high maintenance zones to areas of visual prominence or intensive use by employees and visitors. Not all technical areas or buildings will have high maintenance zones. Irrigation is normally utilized in high maintenance zones.
- C. Medium Maintenance Zone: Areas visually important areas where pedestrian use is moderate. In general, medium maintenance zones are transition zones between the intensive landscaping of the high maintenance zone, and the low maintenance zones. Plants in medium maintenance zones should require only monthly or seasonal maintenance. The plant selection shall emphasize plant species, which have a proven history of low maintenance and drought tolerance. Irrigation may or may not be utilized.
- D. Low Maintenance Zones: The remaining portions of the project site that are not in the high or medium maintenance zones, or which were covered with native vegetation. Re-vegetate low maintenance zones or landscape for erosion and drainage control. Landscape low maintenance zones in a manner that allows them to be treated as native vegetation requiring little or no maintenance. Limit plants to natives and drought tolerant ornamentals that are acclimated to existing environmental conditions. Irrigation normally will not be provided.

- E. Consider scope, location, and time of year in developing maintenance requirements on the Drawings or in the Specifications. Evaluate if a medium or high maintenance zone design is warranted and whether irrigation will be used. Tailor the maintenance requirements of the Standard Specifications to reflect the above factors and to account for the growing seasons within the scope of the project. This will also affect the warranty provisions.

6.0 SEEDING

- A. Reestablish native grasses in all areas disturbed by construction activities. Objectives for seeding include providing erosion control and re-vegetation. Seeding requirements are defined by the following factors:
1. Site conditions: Slopes will require higher seed rates than level grades. Small areas will require higher seed rates than large, open areas. Broadcast seeding will require higher seed rates than drilling. Type of soil may inhibit or enhance growth of seed. Seed types shall be compatible. Refer to the Grass Characteristics and Adaptations matrix (Table 1).
 2. Optimum seeding times: Optimum seeding time is in the spring, after the last frost of the season, especially for warm season varieties. It is possible to seed in the late summer, but do not seed with warm season grasses any later than 6 weeks before the first frost; this will normally be around September 15th.
 - If absolutely necessary to seed after September 15, use a blend with cool season grasses. Any warm season grasses which germinate will most likely die if frosts occur earlier than 6 weeks from time planted. The success rate of a project seeded late in the year (late September through October) is greatly diminished compared to waiting for the following spring.
 - For projects that are seeded after late September, it is advisable to withhold water to prevent seed germination immediately after installation. Seeds that do not germinate in the fall will germinate in the spring, provided they are not washed away by snow melt. There is still a risk that seeds will germinate during a warm period in the winter and then be killed by winter frosts.
- B. Seeding mixtures and rates: In order to maximize the success of seeding and sodding projects, standard seeding mixtures have been developed for the high, medium and low maintenance applications. These standards take into account local availability, maintenance experience, previous project results, seed supplier input, seeding contractor recommendations, and in-house landscaping expertise.

For most projects, the use of the standard mixtures will be appropriate. For unusual situations, a special mix should be designed using the Grass Characteristics and Adaptation matrix (Table 1). All factors related to the project should be given due consideration. The twelve grasses listed are the recommended species for the Los Alamos area.

1. High Maintenance Zones: All areas under this category shall be solid-sodded with a tall fescue blend sod (Triathalon) composed as follows:

33%	Monarch Tall Fescue
33%	Olympic Tall Fescue
6%-10%	Alkali Sacaton

In cases where initial cost is the overriding factor, a seeding mix using the above blend can be used for lawns. This will increase later maintenance costs. Arizona Fescue (Redondo variety) can be substituted in the above mix. Seeding rates for the mix is 10 bulk pounds per 1000 square feet.

2. Medium Maintenance Zones: The areas under this category can be irrigated or non-irrigated. The standard seed mix is as follows:

3%-7%	Sand Dropped
8%-12%	Galleta Grass
6%-10%	Alkali Sacaton
10%-14%	Sideoats Grama
13%-17%	Indian Ricegrass
18%-22%	Sheep Fescue
8%-12%	Blue Grama
18%-22%	Western Wheatgrass

This blend shall be planted at a rate of 25 pure live seed pounds per acre.

3. Low Maintenance Zones: The areas under this category are normally not irrigated. The standard seed mix is as follows:

3%-7%	Alkali Sacaton
8%-10%	Blue Grama
6%-10%	Buffalograss
8%-12%	Galleta Grass
10%-14%	Indian Ricegrass
5%-9%	Little Bluestem
1%-5%	Sand Dropped
13%-17%	Sheep Fescue
8%-10%	Sideoats Grama
18%-22%	Western Wheatgrass

This blend shall be planted at a rate of 15 pure live seed pounds per acre.

- C. Wildflowers: On occasion, it will be desirable to add wildflowers to the medium or low maintenance zone mixes to create a meadow effect for a non-formal appearance. These should be areas where mowing will not be required. Supplemental watering will be required for heavy wildflower meadow growth. A wildflower blend should contain most or all of the following:

Coreopsis Prairie	Coneflower Purple	Blanket Flower Blue Flax
California Poppy Flanders Poppy	Plains Aster Plains	Mexican Hat Oxeye Daisy
Lemon Mint	Prairie Scarlet Flax	Lance-leafed Coreopsis Clover

T

This blend should be mixed with the grass blend at the rate of 20% wildflowers and 80% grasses. Plans should include a note that wildflowers that are considered “noxious weeds” by the local county extension office literature are not permitted.

- D. Mulches: Mulch shall consist of clean cereal grain straw, grass hay, long-fiber wood cellulose gravel, or commercial materials developed for this purpose. Anchor the mulch as required with crimping equipment, soil-anchored mulch, tackifiers, or netting materials.
- E. Seeding Methods:
 - 1. The most common seeding methods are seed drilling and hydro-seeding. Broadcast seeding by machine or hand may be appropriate for small or confined areas.
 - 2. The seeding method will depend on the size and shape of the area, cost, subcontractor in-house or outside contractor work, kind of seed, and available equipment, among others. Drilling introduces seed directly into the prepared seed bed by machine. Hydroseeding uses a slurry composed of water and some or all of the following: seed, fertilizer, mulch and tackifier; the slurry is then sprayed onto the prepared seed bed.

7.0 SODDING

Sodding is recommended under most lawn conditions, because the long-term cost, considering maintenance, is similar to seeding. Sodding is especially appropriate under the following conditions: the need to establish a lawn quickly for high visibility areas, aesthetic purposes, scheduling or program needs; initial high traffic areas with initial low maintenance needs; smaller areas adjacent to buildings, plantings, flower beds or physical features; and slopes or terraces where seeding may be difficult to start and maintain.

- A. Show sodding details on plans, consistent with the Standard Specifications. Include a typical cross section showing elements of subgrade, topsoil, top dressing, and soil amendments, to include thicknesses and/or rates of application. Verify that the type of grass sod in the standard specification is suitable for this specific application.
- B. When sodding on a slope, include anchorage details in the plans.
- C. Consider whether temporary, permanent, or no irrigation will be available to establish and maintain desired growth.

8.0 PLANTING

Planting as defined in this section includes trees, shrubs, ground covers, vines, and native plants. Planting objectives include but are not limited to:

- A. Use landscaping to prevent erosion, runoff, and soil damage to new and existing facilities.
 - 1. Landscape construction sites that have been denuded of natural vegetation to their natural state.
 - 2. Planting shall support the security and safety requirements.
 - 3. Use plants to modify environmental problems such as temperature fluctuations, snow accumulation, noise abatement, light reflection, and energy and water conservation.

- B. Verify Plant Availability

- 1. When a plant list has been established, verify local or regional availability of the specified plant materials. When a plant is not readily available in the nursery trade, note on the Drawings suggested sources for that plant.
 - 2. When native plants are specified for a project, verify with local or regional suppliers that the native plant materials will be available during the period of installation. Verification of availability shall be done prior to specifying native plant materials.

- C. Minimum Plant Sizes

Specify plant materials in the following minimum sizes. These standards may or may not be applied to re-vegetation projects; determination for re-vegetation projects will be by experienced in-house LANL or Subcontractor professional operations personnel.

- 1. Deciduous Trees: 2 inch caliper or 24 inch container sizes.
 - 2. Evergreen Trees: 6 to 10 foot heights except native pinon pines and junipers (shall be 6 to 8 foot heights).
 - 3. Shrubs: Height or spread 3 feet or more: 5 gallon sizes.
 - 4. Height or spread less than 3 feet: 1 or 3 gallon size.
 - 5. Ground Covers: Woody stock, 1 gallon size.
 - 6. Herbaceous stock: 4 inch pot sizes.
 - 7. Vines: 5 gallon sizes.
 - 8. Native Shrubs: Use largest practical size.
 - 9. Use the American Association of Nurserymen standards as the minimum plant specification.

- D. Planting/Backfill Mix

- 1. Refer to LANL Standard Construction Specifications, Section 02950 Trees, Plants, and Ground Cover.

E. Maintenance

1. Refer to LANL Standard Construction Specifications, Section 02950 Trees, Plants, and Ground Cover.

9.0 IRRIGATION**A. General**

1. Provide permanent or temporary irrigation systems for new planting or re-vegetated sites as defined by:
 - a. Permanent irrigation system shall incorporate rigid PVC pipe.
 - b. Temporary irrigation systems shall be considered to be above ground aluminum pipe or PVC system, truck or sprayer system, and shallow burial drip irrigation system.
2. Limit temporary systems to areas where water is required for plant establishment, but not for long-term maintenance. Temporary irrigation shall be supplied to native grass and wildflower seeding at minimum of 6 weeks.
3. Temporary drip systems may be relied upon for a maximum of 2 years. If possible, temporary drip systems will be on an automatic remote control valve.

B. Irrigation Site Analysis

1. During site analysis, consider drainage, topography, and soil factors that affect irrigation design.
2. Consider environmental conditions such as aspect of slope orientation and precipitation.
3. Account for existing utilities including underground, aboveground, manholes, valve boxes, cleanouts, etc. and supply flow capacity factors.
4. Consider existing landscaping and maintenance availability.

C. Irrigation Design Elements

1. Draw the irrigation plan to scale and show or note the locations of all irrigation equipment including: controllers, backflow preventors, valves, heads, and pipes. All irrigation drawings shall be submitted for approval to LANL FWO Utilities and Infrastructure Grounds representative.
2. List irrigation equipment on an equipment schedule. The equipment schedule shall show each equipment symbol, list the manufacturer and the model number (when applicable) the size and the installation detail number.
3. Include in the Drawings installation details for each irrigation head and equipment type used in the irrigation design.
4. Show the point of connection (PtOC) for the irrigation system to the existing or proposed water line. Coordinate the PtOC with the utility plan. Connections to water mains should be avoided – use a PtOC within the structure’s mechanical equipment room. The system shall be comprised of the interior backflow preventer with a valve in a control box at the exterior wall. The valve will be a control, stop/waste valve with a fitting for the blowdown of the sprinkler system at the start of winter.
5. Show the location of the controller and electrical connections on the irrigation plan.

6. Provide design calculation in accordance with standard engineering hydraulic principles. Calculations shall be reviewed by a Professional Engineer.
7. The standard bury depth for pressurized mainlines shall be 48 inches, and 12 inches for non-pressurized lines. Designate the primary distribution lines from the master valve to zone valves as non-pressurized lines.
8. Electrical Connections
 - a. When practical, provide a dedicated electrical breaker for the irrigation controller.
 - b. When possible, controllers for irrigation systems in secure areas shall not be located in buildings requiring special access.

D. Irrigation Equipment Standards

Listed below is the standard for irrigation equipment at Los Alamos National Laboratory. In designing irrigation projects, calculations shall be based on the equipment standards or ESM POC approved-equal equipment.

1. Irrigation heads shall have parts that are interchangeable with the following irrigation heads without the need for adapters.
 - a. Large Radius Heads 50 Foot Radius: Toro 640
 - b. Medium Radius Heads 30 Foot Radius: Toro Super 700
 - c. Lawn Pop-ups: Toro 570-4P
 - d. Shrub Spray Pop-ups: Toro 570-6P or Toro 570-HP
 - e. Bubblers-Flood or Stream: Toro 500 series
 - f. Bubblers-Adjustable Flood: Toro 514-20
 - g. Electric Remote Control Valves: Toro 216 series brass body
2. Adjustable Pressure Regulators with pressure gages
3. Gate Valves: Brass body type up to 2 inch sizes or an iron body type more than 2 inch sizes, and include valve boxes. If an irrigation connection has to be made to a water main, the material from the main to the backflow preventer shall be in conformance with LANL Standard Specification 02512.
4. Piping: Irrigation mainlines downstream from the master valve shall be Schedule 40 PVC pipe. Irrigation laterals shall be Class 200 PVC pipe. If an irrigation connection has to be made to a water main, the material from the main to the backflow preventer shall be in conformance with LANL Standard Specification 02512.
5. Government Furnished Equipment (G.F.E.): Installation of connection to supply and piping to control manhole.
7. Reduced pressure backflow preventer. See LANL Standard Specifications 02512 and 15140.
8. Control manhole and appurtenances for the above.

TABLE 1
GRASS CHARACTERISTICS AND ADAPTATIONS

For information purposes and special applications only; standard mixes shall prevail.

COMMON NAME	BOTANICAL NAME	(1) HGT.	COOL/ WARM SEASON	BUNCHGRASS, SODFORMER, OR BOTH	NATIVE OR INTRODUCED	MIN. AMT. OF PRECIP. (INCHES)	BEST SOIL TEXTURE	(2) SEEDING RATE	(3) PLANTING TIME
Alkali Sacaton	Sporobolus Airoides	M	W	B	N	6	MED-FINE	2-3	LATE SUM
Arizona Fescue	Festuca Arizonica	M-T	C	B	N	14	MED	3-6	F
Blue Gram	Bouteloua Gracilis	S-M	W	B-S	N	12-14	MED	2-3	SUM
Buffalograss	Buchloe Dactyloides	S	W	S	N	12	MED	4-8	SP
Galleta Grass	Hilaria Jamesii	S	W-	B-S	N	8	FINE	6	SP
Indian Ricegrass	Oryzopsis Hymenoides	M	C	B	N	9	COARSE	6-B	F
Little Bluestem	Schizachyrium Scoparium	M	W	B	N	14	MED	3-4	SP/SUM
Sand Dropseed	Sporobolus Cryptandrus	M	W	B	N	10	COARSE	1	LATE SUM
Sheep Fescue	Festuca Ovina	M	C	B	N	10-12	MED	10	F/SP
Sideoats Gram	Bouteloua Curtipendula	M	W	B-S	N	8	MED	4-10	SUM
Tall Fescue	Festuca Arundinacea	T	C	B	I	16-20	MED-FINE	8	SP
Western Wheatgrass	Agropyron Smithii	M	C	S	N	10	MED-FINE	10	F/SP

(1) Height: Short (S) 1" To 12"; Medium (M) 13" To 24"; Tall (T) 25"+

(2) Seeding Rate: Pure Live Seed (PLS) Pounds Per Acre; PLS = % Purity X % Germination X Bulk Pounds; (1 Acre = 43560 Sq. FT.)

(3) Planting Time: F=Fall, Sp=Spring, Sum=Summer

Note: Seeding rate ranges shown are for drilled seed or hydro-seed in large areas. Lower range is for level areas and higher for slopes. Also, increase rates 50% to 100% for mechanical broadcast seeding. For small or confined areas increase rates shown to insure heavy coverage.

All high maintenance lawn areas shall be solid-sodded using a tall fescue sod blend (Triathalon) which is locally available.